

WHAT IS CLAIMED IS:

1. A distance measuring method for measuring a distance between a distance measurement system and a measurement object, said method comprising the steps of:
 - (1) sending a first electromagnetic wave toward said measurement object as a first traveling wave, said measurement object reflecting said first traveling wave to produce a first reflected wave;
 - (2) changing a frequency of said first traveling wave;
 - 10 (3) detecting an amplitude of a first standing wave at a first position of said distance measurement system and producing a first amplitude signal representing the amplitude of said first standing wave, said first standing wave produced by interference between said first reflected wave and said first traveling wave; and
 - 15 (4) executing a first calculation using said first amplitude signal to derive a first distance between said first position and said measurement object and to derive a first relative speed between said first position and said measurement object.
2. The distance measuring method according to claim 1, further comprising the steps of:
 - sending a second electromagnetic wave toward said measurement object as a second traveling wave so that said measurement object reflects said second traveling wave to produce a second reflected wave;
 - changing a frequency of said second traveling wave;
 - 25 detecting an amplitude of a second standing wave at a second position of said distance measurement system and producing a second amplitude signal representing the amplitude of said second standing wave, said second standing wave produced by interference between said second reflected wave and said second traveling wave; and

executing a second calculation using said second amplitude signal to derive a second distance between said second position and said measurement object and a second relative speed between said second position and said measurement object.

5 3. The distance measuring method according to claim 2, further comprising the step of synchronizing execution of said first calculation and execution of said second calculation.

4. The distance measuring method according to claim 2, further comprising the step of calculating space coordinates of said measurement
10 object based on said first and second distances, said first and second relative speeds, and said first and second positions.

5. The distance measuring method according to claim 1, wherein said step (2) comprises changing the frequency of said first traveling wave stepwise.

6. The distance measuring method according to claim 5, wherein said
15 step (3) is executed after a lapse of a predetermined time from a time instant when the frequency of said first traveling wave is changed.

7. The distance measuring method according to claim 6, wherein said predetermined time is set longer than a time from said time instant when the frequency of said first traveling wave is changed, to a time instant when said
20 first traveling wave reaches said first position as said first reflected wave.

8. The distance measuring method according to claim 5, wherein the frequency of said first traveling wave is changed according to a predetermined pattern.

9. The distance measuring method according to claim 5, wherein the
25 frequency of said first traveling wave is changed at random.

10. A distance measuring device for measuring a distance to a measurement object, said device comprising:

 a first electromagnetic wave generator for producing a first electromagnetic wave;

- a first transmission section connected to said first electromagnetic wave generator for sending said first electromagnetic wave toward said measurement object as a first traveling wave, wherein said measurement object reflects said first traveling wave to produce a first reflected wave;
- 5 a first frequency control section connected to said first electromagnetic wave generator for changing a frequency of said first traveling wave;
- a first amplitude detecting section for detecting an amplitude of a first standing wave at a first position and producing a first amplitude signal representing the amplitude of said first standing wave, said first standing wave
- 10 produced by interference between said first reflected wave and said first traveling wave; and
- a first arithmetic section connected to said first amplitude detecting section for executing a first calculation using said first amplitude signal to derive a first distance between said first position and said measurement object and a
- 15 first relative speed between said first position and said measurement object.
11. The distance measuring device according to claim 10, further comprising:
- a second electromagnetic wave generator for producing a second electromagnetic wave;
- 20 a second transmission section connected to said second electromagnetic wave generator for sending said second electromagnetic wave toward said measurement object as a second traveling wave, wherein said measurement object reflects said second traveling wave to produce a second reflected wave;
- 25 a second frequency control section connected to said second electromagnetic wave generator for changing a frequency of said second traveling wave;
- a second amplitude detecting section for detecting an amplitude of a second standing wave at a second position and producing a second amplitude

signal representing the amplitude of said second standing wave, said second standing wave produced by interference between said second reflected wave and said second traveling wave; and

- a second arithmetic section connected to said second amplitude
5 detecting section for executing a second calculation using said second
amplitude signal to derive a second distance between said second position and
said measurement object and a second relative speed between said second
position and said measurement object.

12. The distance measuring device according to claim 11, further
10 comprising a synchronization control section connected to said first and second
arithmetic sections for synchronizing execution of said first calculation and
execution of said second calculation.

13. The distance measuring device according to claim 11, further comprising a coordinate calculating section connected to said first and second arithmetic sections for calculating space coordinates of said measurement object based on said first and second distances, said first and second relative speeds, and said first and second positions.

14. The distance measuring device according to claim 10, wherein
said first frequency control section comprises a stepwise control section that
20 changes the frequency of said first traveling wave stepwise.

15. The distance measuring device according to claim 14, further comprising a detection control section connected to said first amplitude detecting section and said stepwise control section for causing said first amplitude detecting section to execute detection of the amplitude of said first standing wave after a lapse of a predetermined time from a time instant when the frequency of said first traveling wave is changed.

16. The distance measuring device according to claim 15, further comprising a time setting section connected to said detection control section and said first frequency control section for setting said predetermined time to be

longer than a time from said time instant when the frequency of said first traveling wave is changed, to a time instant when said first traveling wave reaches said first position as said first reflected wave.

17. The distance measuring device according to claim 14, wherein
5 said first frequency control section changes the frequency of said first traveling wave according to a predetermined pattern.

18. The distance measuring device according to claim 14, wherein
said first frequency control section changes the frequency of said first traveling wave at random.

10 19. The distance measuring device according to claim 10, wherein
said first electromagnetic wave generator comprises a light emitting section for
emitting light, as said first electromagnetic wave, of which a light intensity
changes periodically, said first electromagnetic wave generator is an optical
device having a function of transmitting therethrough at least part of said light
15 and discharging it as said first traveling wave, and said first frequency control
section controls the frequency of said light.

20 20. A distance measuring structure for measuring a distance to a
measurement object, said structure comprising:
a plurality of distance measuring devices each according to claim 10;
a synchronization control device connected to said distance measuring
devices for synchronizing operations of said first arithmetic sections provided in
said distance measuring devices, respectively; and
a coordinate calculating device connected to said distance measuring
devices for calculating space coordinates of said measurement object based on
25 said first distances and said first relative speeds derived in said distance
measuring devices, respectively, and a positional relationship of said first
amplitude detecting sections provided in said distance measuring devices,
respectively.